



***Federal Railroad Administration
Office of Railroad Safety
Accident and Analysis Branch***

***Accident Investigation Report
HQ-2019-1336***

***Regional Transportation District-Commuter (RTDC)
Aurora, Colorado
May 6, 2019***

Note that 49 U.S.C. §20903 provides that no part of an accident or incident report, including this one, made by the Secretary of Transportation/Federal Railroad Administration under 49 U.S.C. §20902 may be used in a civil action for damages resulting from a matter mentioned in the report.



SYNOPSIS

On May 6, 2019, at 10:18 a.m., MDT, Regional Transportation District-Commuter (RTDC) passenger train 4056 (Train 1), struck a semi-tractor trailer (Vehicle 1) at Milepost (MP) 10.36, Sable Boulevard, in the City of Aurora, Colorado. The method of operation for RTDC on the East Line is Traffic Control System (TCS) supplemented by a Positive Train Control (PTC) overlay. The crossing is a public crossing equipped with warning lights, bells, gates, and a pre-signal.

The accident resulted in four injuries to the train passengers including an injury to the contract transportation safety officer (TSO) who was onboard the train. No injuries to the train operator nor the truck driver occurred. No rail equipment derailed and no hazardous materials were released. An estimated \$200,000 damage was reported to railroad equipment, and \$31,000 damage to track and signal equipment.

The weather at the time of the incident was partly cloudy, a temperature of 67F, with a 9 mph wind out of the northeast.

The Federal Railroad Administration (FRA) investigation determined the probable cause was M308 — Highway user deliberately disregarded crossing warning device.

FRA did not identify any contributing factors.



FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File #HQ-2019-1336

TRAIN SUMMARY


1. Name of Railroad Operating Train #1 Regional Transit District- Commuter	1a. Alphabetic Code RTDC	1b. Railroad Accident/Incident No. 050619
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GENERAL INFORMATION

1. Name of Railroad or Other Entity Responsible for Track Maintenance Regional Transit District- Commuter		1a. Alphabetic Code RTDC		1b. Railroad Accident/Incident No. 050619	
2. U.S. DOT Grade Crossing Identification Number 906047B		3. Date of Accident/Incident 5/6/2019		4. Time of Accident/Incident 10:18 AM	
5. Type of Accident/Incident RR Grade Crossing					
6. Cars Carrying HAZMAT 0	7. HAZMAT Cars Damaged/Derailed 0	8. Cars Releasing HAZMAT 0	9. People Evacuated 0	10. Subdivision REGIONAL TRANSIT DISTRICT	
11. Nearest City/Town Aurora		12. Milepost (to nearest tenth) 10.36	13. State Abbr. CO	14. County ADAMS	
15. Temperature (F) 67 °F	16. Visibility Day	17. Weather Clear		18. Type of Track Main	
19. Track Name/Number Main Track 1		20. FRA Track Class Freight Trains-60, Passenger Trains-80		21. Annual Track Density (gross tons in millions)	22. Time Table Direction North
23. PTC Preventable No		24. Primary Cause Code [M308] Highway user deliberately dis		25. Contributing Cause Code(s)	

**OPERATING TRAIN #1**

1. Type of Equipment Consist: EMU					2. Was Equipment Attended? Yes		3. Train Number/Symbol 4056/4055					
4. Speed (recorded speed, if available) R - Recorded 45.0 MPH E - Estimated		Code R	5. Trailing Tons (gross excluding power units)		6a. Remotely Controlled Locomotive? 0 = Not a remotely controlled operation 1 = Remote control portable transmitter 2 = Remote control tower operation 3 = Remote control portable transmitter - more than one remote control transmitter						Code 0	
6. Type of Territory Signalization: <u>Signaled</u> Method of Operation/Authority for Movement: <u>Signal Indication</u> Supplemental/Adjunct Codes: <u>Q, B, J</u>												
7. Principal Car/Unit	a. Initial and Number		b. Position in Train		c. Loaded (yes/no)		8. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box		Alcohol	Drugs		
(1) First Involved (derailed, struck, etc.)	RTDC004056		1		yes				0	0		
(2) Causing (if mechanical, cause reported)							9. Was this consist transporting passengers?			Yes		
10. Locomotive Units (Exclude EMU, DMU, and Cab Car Locomotives.)	a. Head End	Mid Train b. Manual c. Remote		Rear End d. Manual e. Remote		11. Cars (Include EMU, DMU, and Cab Car Locomotives.)		Loaded a. Freight b. Pass.		Empty c. Freight d. Pass.		e. Caboose
(1) Total in Train	0	0	0	0	0	(1) Total in Equipment Consist		0	4	0	0	0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed		0	0	0	0	0
12. Equipment Damage This Consist 200000		13. Track, Signal, Way & Structure Damage 31000										
Number of Crew Members						Length of Time on Duty						
14. Engineers/Operators 1	15. Firemen 0		16. Conductors 0		17. Brakemen 0		18. Engineer/Operator Hrs: 6 Mins: 17		19. Conductor Hrs: Mins:			
Casualties to:		20. Railroad Employees		21. Train Passengers		22. Others		23. EOT Device? N/A		24. Was EOT Device Properly Armed? N/A		
Fatal		0		0		0		25. Caboose Occupied by Crew?		N/A		
Nonfatal		0		4		0						
26. Latitude 39.762236000				27. Longitude -104.819310000								

 U.S. Department of Transportation Federal Railroad Administration		FRA FACTUAL RAILROAD ACCIDENT REPORT		FRA File #HQ-2019-1336	
CROSSING INFORMATION					
Highway User Involved			Rail Equipment Involved		
1. Type Truck-Trailer			5. Equipment EMU Locomotive(s)		
2. Vehicle Speed (<i>est. mph at impact</i>) 10		3. Direction (<i>geographical</i>) South		6. Position of Car Unit in Train 1	
4. Position of Involved Highway User Moved over Crossing			7. Circumstance Rail Equipment Struck Highway User		
8a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? Neither			8b. Was there a hazardous materials release by Neither		
8c. State here the name and quantity of the hazardous material released, if any. N/A					
9. Type of Crossing 1. Gates 4. Wig wags 7. Crossbucks 10. Flagged by crew 2. Cantilever FLS 5. Hwy. traffic signals 8. Stop signs 11. Other (<i>spec. in narr.</i>) 3. Standard FLS 6. Audible 9. Watchman 12. None 5, 1, 3, 6, 7			10. Signaled Crossing Warning 1, 1, 1, 1		11. Roadway Conditions Dry
12. Location of Warning Both Sides		13. Crossing Warning Interconnected with Highway Signals Yes		14. Crossing Illuminated by Street Lights or Special Lights Yes	
15. Highway User's Age 34	16. Highway User's Gender Male	17. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train No		18. Highway User Other (specify in narrative)	
19. Driver Passed Standing Highway Vehicle No		20. View of Track Obscured by (<i>primary obstruction</i>) Not Obstructed			
Casualties to:		Killed	Injured	21. Driver was Uninjured	
23. Highway-Rail Crossing Users		0	0	24. Highway Vehicle Property Damage (<i>est. dollar damage</i>) 15000	22. Was Driver in the Vehicle? Yes
25. Total Number of Vehicle Occupants (<i>including driver</i>) 1					
26. Locomotive Auxiliary Lights? Yes			27. Locomotive Auxiliary Lights Operational? Yes		
28. Locomotive Headlight Illuminated? Yes			29. Locomotive Audible Warning Sounded? Yes		

10. Signaled Crossing Warning
Explanation Code

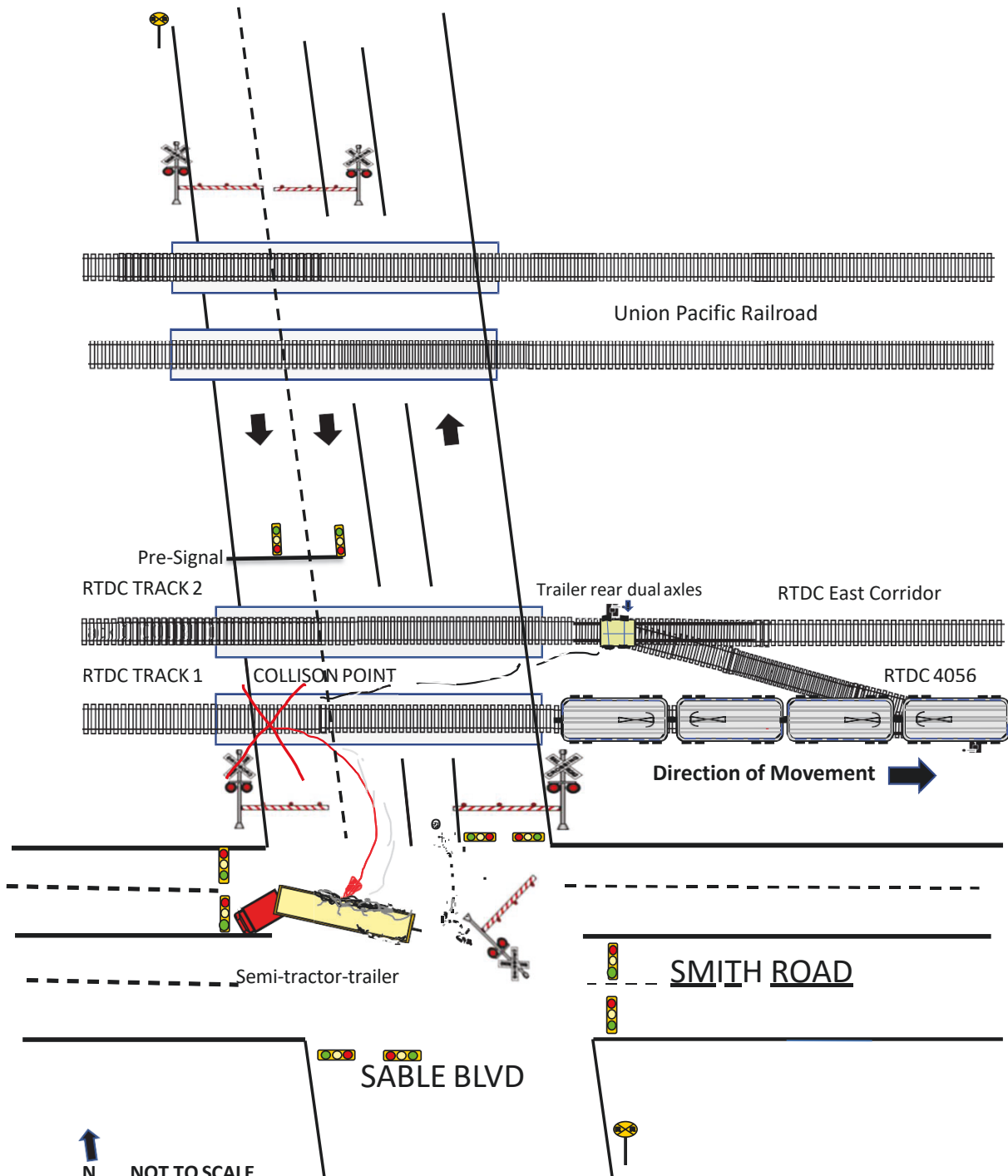
- 1 - Provided minimum 20-second warning
- 2 - Alleged warning time greater than 60 seconds
- 3 - Alleged warning time less than 20 seconds
- 4 - Alleged no warning
- 5 - Confirmed warning time greater than 60 seconds
- 6 - Confirmed warning time less than 20 seconds
- 7 - Confirmed no warning
- N/A - N/A

- A - Insulated rail vehicle
- B - Storm/lightning damage
- C - Vandalism
- D - No power/batteries dead
- E - Devices down for repair
- F - Devices out of service
- G - Warning time greater than 60 seconds attributed to accident-involved train stopping short of the crossing, but within track circuit limits, while warning devices remain continuously active with no other in-motion train present
- H - Warning time greater than 60 seconds attributed to track circuit failure (e.g., insulated rail joint or rail bonding failure, track or ballast fouled)
- J - Warning time greater than 60 seconds attributed to other train/equipment within track circuit limits
- K - Warning time less than 20 seconds attributed to signals timing out before train's arrival at the crossing/island circuit
- L - Warning time less than 20 seconds attributed to train operating counter to track circuit design direction
- M - Warning time less than 20 seconds attributed to train speed in excess of track circuit's design speed
- N - Warning time less than 20 seconds attributed to signal system's failure to detect train approach
- O - Warning time less than 20 seconds attributed to violation of special train operating instructions
- P - No warning attributed to signal systems failure to detect the train
- R - Other cause(s). Explain in Narrative Description

SKETCHES

Sketch - HQ-2019-1336_Sketch

HQ-2019-1336



NARRATIVE

Circumstances Prior to the Accident

The crew of Regional Transit District-Commuter (RTDC) passenger train 4056 (Train 1) consisted of a train operator. The operator went on duty at 4:01 a.m., MDT, on May 6, 2019, at RTDC's Rail Maintenance Facility in Denver, Colorado, and had the statutory off-duty period before beginning his shift. Additionally, a contract transportation safety officer (TSO) was assigned to the train.

Train 1 consisted of 4 electrical multiple units (EMU), and was 344 feet long. A Class I brake test was performed at 9:10 p.m., on May 5, 2019, and a running brake test was conducted by the operator at Union Station prior to departure.

Train 1 had completed three trips, and was traveling timetable south from Denver Union Station to the Denver Airport Station on its fourth trip. The operator was seated at the controls on the right side of the cab, and the TSO was in the passenger compartment of the second EMU. Fifty-six passengers were on the train at the time of the accident.

The Sable Boulevard highway-rail grade crossing (the crossing) is a public highway-rail grade crossing, DOT No. 906047B, at Milepost (MP) 10.36 in Aurora, Colorado. Sable Boulevard is a two-lane concrete and asphalt roadway that runs geographically north and south, and intersects with four main line tracks.

The speed limit for motor vehicles on Sable Boulevard is 30 mph. The crossing is located approximately one-half mile south of U.S. Interstate 70, and a quarter mile east of U.S. Interstate 225. Approaching the crossing on Sable Boulevard from the north, the road widens to two southbound lanes, and there is a 120-foot-long center median before four quadrant automatic gates equipped with lights and bells, pavement markings, and crossbucks prior to reaching the first two main lines operated by Union Pacific Railroad Company (UP). Immediately after the UP main tracks, there is a 23-foot-long center median leading up to another two main tracks operated by RTDC before reaching a 27-foot-long center median that extends to the intersection of Sable Boulevard and Smith Road. The crossing is also equipped with buried loop vehicle detection to detect vehicles that are within the crossing when the warning devices activate, and prevent them from becoming trapped on the tracks between the entrance and exit gates. A traffic signal is located between the two sets of tracks to provide advance warning, with stop lines painted on the road clear of all tracks.

RTDC Track Nos. 1 and 2 approaching the crossing from the west are predominately tangent with a gentle S-curve approximately 1,000 feet west of the crossing. This section of track is on a .57-percent ascending grade for northward trains. The maximum authorized speed on the RTDC main tracks is 79 mph, and the method of operation is a Traffic Control System (TCS) supplemented by a Positive Train Control (PTC) overlay.

At about 10:16 a.m., Train 1 proceeded from its scheduled stop at Peoria Station, located about 1.9 miles west of the crossing, on RTDC Main Track 1. Train 1 accelerated to a recorded speed of 55 mph as it passed the grade separation at U.S. Interstate 225, and approached the crossing.

A 2011 Freightliner semi-truck (Vehicle 1), pulling an empty 53-foot trailer, was traveling south on Sable Boulevard, disregarded the red traffic light, and entered the crossing. The driver of Vehicle 1 stopped at the red traffic signal fouling the UP tracks, and then observed the northbound gates activate in the opposite direction of travel. The driver then attempted to back up until he observed the southbound gates

lower on the truck trailer. The driver hesitated for several seconds before he noticed the southbound exit gates in his lane of travel were still raised, and he began to drive forward to exit the crossing.

The Accident

Train 1 continued to accelerate and the Operator had an unobstructed view as it approached the crossing. The Operator of Train 1 observed Vehicle 1 on the north side of the crossing and began the normal grade crossing horn sequence. At about 10:18 a.m., the Operator recognized Vehicle 1 would not clear the crossing and initiated an emergency brake application while traveling a recorded 67 mph, approximately 800 feet from the crossing. Train 1 struck Vehicle 1 about 9 seconds after the emergency brake application, traveling a recorded 45 mph.

The impact was near the rear trailer wheels causing the trailer to spin clockwise approximately 60 degrees coming to rest in the northwest corner of the Sable Boulevard and Smith Road intersection. As it did, the trailer impacted the southbound crossing light and gate assembly located in the center median, destroying it, and causing debris to strike a vehicle stopped at the intersection in the westbound lane of Smith Road. The impact also caused the trailer's tandem axle assembly to disconnect from the trailer catapulting it 120 feet from the point of impact onto RTDC Control Point Sable Switch, resulting in damage to the interlocking tracks. The tractor remained attached to the trailer and both remained in the upright position. The truck driver as well as the occupants of the vehicle stopped at the intersection of Sable Boulevard and Smith Road were uninjured and did not require medical treatment.

After the collision, Train 1 came to a stop 375 feet beyond the eastern edge of the crossing pavement. The Operator stated that after the impact and the train coming to a stop, he used the radio to advise the Operations Control Center (OCC) of the collision, and the OCC Train Dispatcher notified 911 at 10:19 a.m. The Operator then began to check on the passengers, and met up with the TSO on board. The TSO indicated he was OK and was not aware of any injuries to passengers.

First responders from the Aurora Fire Department and Faulk Rocky Mountain Ambulance responded to the accident. The overhead power was disconnected and the pantograph lowered at about 10:41 a.m. RTDC notified UP of the crossing incident at 10:47 a.m. A UP Signal Maintainer was sent to inspect the crossing signal equipment for damage.

The emergency responders boarded the train and evaluated the passengers and crew for injuries while ensuring the elimination of any hazards. The responders then assisted in the evacuation of the passengers and train crew from the train. The evacuation process commenced at 11:18 a.m. and concluded at 11:24 a.m. All 56 passengers and 2 crew members were evacuated through the west facing end door, directly to the track. This was determined the safest location for the evacuations due to walking conditions along the side of the train, and provided a direct path to Sable Boulevard. No Americans with Disabilities Act (ADA) assistance was necessary for any of the passengers exiting the train.

One passenger and the TSO received non-life-threatening injuries and were subsequently transported to local medical facilities. Two additional passengers notified RTDC later that day they had also sustained injuries.

An estimated \$200,000 damage was reported to railroad equipment, and \$31,000 damage to track and signal equipment.

Post-Accident Investigation

On May 6, 2019, the Federal Railroad Administration (FRA) began an investigation of this accident/incident. FRA assigned Operating Practices, Grade Crossing, and Signal and Train Control inspectors to the accident investigation.

Upon commencing its investigation, FRA investigators inspected the accident site, active warning devices at the crossing, toxicology analysis, fatigue analysis of the striking train's crew, and rules compliance. After their on-site inspection and investigation, FRA conducted interviews with the train crew of the striking train. FRA's investigators also requested and received all records, forms, and other documentation necessary to conduct their final analysis and draw conclusions concerning the pertinent facts of the accident/incident. The following analysis and conclusions, as well as any possible contributing factors and the probable cause in this report, represent the findings of FRA's investigation.

Analysis and Conclusions

Analysis -- Toxicology Testing: The driver of the truck was evaluated at the scene by the Aurora Police Department who determined the driver was not impaired or under the influence of alcohol or other substances.

FRA does not require toxicological testing of the train crew for this type of accident. However, RTDC policy does require this testing of its employees. The results of the Operator's toxicology testing were negative.

Conclusion: FRA determined drugs and alcohol did not contribute to the cause or severity of the accident.

Analysis -- Highway Rail Grade Crossing (HRGX) Warning Devices: This highway-rail grade crossing is equipped with advance warning signs, crossing pavement markings, crossing limit line pavement markings, crossbucks, active warning lights, automatic gates, and automated bells. Emergency Notification System (ENS) signs are posted at the crossing for each direction of travel. Signage was in place in accordance with Manual on Uniform Traffic Control Device (MUTCD) standards.

The truck driver had a clear view of the approaching train. A 375-foot collision barrier sits between the RTDC and UP tracks west of Sable Boulevard. This wall did not preclude the truck driver from being able to see the approaching train. The driver acknowledged to law enforcement he saw the train approaching. The buried loop vehicle detection system worked as designed, and the southbound exit gates remained in the raised position to allow Vehicle 1 to exit the crossing.

The crossing warning signs and devices at this crossing were all in good condition. The warning system provided 39 seconds of activation warning time; this is within the activation parameters for the crossings.

Conclusion: FRA determined the HRGX warning devices did not contribute to the cause or severity of the accident.

Analysis – RTDC Waiver FRA-2016-0028: Starting April 19, 2016, RTDC requested permission to operate passenger trains along the “A” and “B” lines subject to certain conditions. FRA issued a series of waivers allowing service to operate while RTD and Denver Transit Partners (DTP) made software and hardware modifications to bring the PTC Wireless Crossing Activation System (WCAS) and Conventional Track Circuit Warning System (CTWS) at each crossing into compliance with FRA's regulations regarding crossing activation times.

On September 8, 2017, RTD asked FRA to consider as acceptable, activations that occur within a 20-second window, with activations occurring within “5 seconds before and 15 seconds after” the

programmed warning times.

On September 28, 2017, FRA granted a five-year waiver to operate trains on the RTD “A” and “B” lines subject to the conditions listed in FRA-2016-0028.

Sable Boulevard Crossing DOT No. 906047B is one of the crossings included in waiver FRA-2016-0028. The Sable crossing has a programmed warning time of 36 seconds. Per the waiver condition of a 20-second window, the crossing has minimum activation warning time of 31 seconds and maximum activation warning time of 51 seconds. These times are reflective of the PTC WCAS system being active and operational. FRA reviewed the data logs from the Sable Boulevard accident and determined the system provided 39 seconds of activation warning time. This activation time is within the parameters of the waiver for the Sable Boulevard crossing.

Conclusion: FRA determined waiver FRA-2016-0028 did not contribute to the cause or severity of the accident.

Analysis - EMU safety devices: Lead Unit No. 4056 was equipped with a headlight, auxiliary lights, and an audible warning device required by Federal regulations. FRA inspectors at the incident observed the headlight and auxiliary lights were on. The event recorder indicated the locomotive horn began sounding 22 seconds prior to and up to the time of the collision. The event recorder indicates PTC and Automatic Train Control (ATC) were cut-in at the time of the accident.

Lead RTDC 4056's headlight, auxiliary lights, and horn were operational and in compliance with Federal requirements at the time of this accident. Both the ATC and PTC systems were operating as intended at the time of the accident.

Conclusion: FRA determined the EMU safety devices did not contribute to the cause or severity of the accident.

Analysis - Train Operator Performance: The RTDC train Operator observed the vehicle on the Sable Boulevard crossing from approximately 2,400 feet away as the train approached. Per the event recorder, the Operator activated the train horn early at 10:18:20 a.m., 22 seconds prior to impact. The Operator placed the train into emergency at 10:18:33 a.m., at a recorded speed of 67 mph, approximately 800 feet from the crossing. The train impacted the semi-truck trailer at approximately 10:18:42 a.m., 9 seconds after the train emergency brake application, at a recorded speed of 45 mph. After the collision, the Operator contacted OCC and advised them of the collision. The Operator self-assessed and determined he was not injured. He then began checking on the passengers for any injuries until emergency services arrived and boarded the train.

FRA concluded the train Operator was operating in compliance with all applicable RTDC railroad operating and train-handling requirements.

Conclusion: FRA determined the train Operator performance did not contribute to the cause or severity of the accident.

Analysis – Training, Experience, and Qualifications: FRA was provided with documentation of the Operator's training and qualification records from RTDC with no exceptions noted. FRA determined that the Operator was a certified and qualified EMU Operator, and all required training and tests were current.

Conclusion: FRA determined training, experience, and qualifications did not contribute to the cause or severity of this accident.

Analysis - Fatigue Analysis Data: FRA obtained fatigue-related information, including a 10-day work

history, for the train Operator involved in this accident. Based on the biomathematical analysis, fatigue was not probable for the train Operator involved in the accident.

Conclusion: FRA determined fatigue did not contribute to the cause or severity of the accident.

Analysis – Outside Agency Findings: The Aurora Police Department determined the driver of the semi-truck trailer failed to recognize the need to exit the crossing zone and spent too much time attempting to back out versus moving forward out of harm's way. Due to this delayed reaction, there was not enough time to exit the crossing and prevent the collision. The police report concluded the driver of the truck was at fault in the crash due to careless driving.

The Aurora Police Department charged the driver of the semi-tractor trailer with careless driving, a violation of Colorado Traffic Law 42-4-1402.

Conclusion: FRA determined the driver's actions were the probable cause of the accident.

Overall Conclusions

The railroad and train Operator followed all RTDC and applicable Federal standards.

The driver of Vehicle 1 was cited for careless driving, Colorado Traffic Law 42-4-1402. The truck driver failed to navigate this crossing properly, resulting in the accident. FRA concluded this accident occurred because the truck driver operated the vehicle in a manner that caused a delay in the vehicle clearing the crossing. The driver then attempted to cross the tracks ahead of the approaching train with too little time to avoid the collision.

Probable Cause and Contributing Factors

The FRA investigation determined the probable cause was M308 -- Highway user deliberately disregarded crossing warning device.

FRA did not identify any contributing factors.